EAST DELTA UNIVERSITY

Data Visualization, Analysis and Interpretation using MS Power BI

A Case Study of Food prices in Bangladesh,

World Food Programme Price Database

by Mohammed Amimul Ehasan Shakib

Student ID: 241001661

Supervisor: Mr. Hasan Mahmud

E A S T   D E L T A   U N I V E R S I T Y

Master Of Science In Data Analytics And Design Thinking For Business

Mojaffornogor, Chattogram, Bangladesh

Table of Contents

1. Introduction

1.1 Background and Context

The dataset focums on food prices in Bangladesh, sourced from the World Food Programme Price Database. The dataset contains essential information on food prices collected from various markets across different regions of Bangladesh. Spanning from July 1998 to August 2024, it includes key columns as follow:

- Date: The date of data collection.
- Division (admin1): Geographic division within Bangladesh.
- District(admin2): The district within the division.
- Market: The specific market where the data was collected.
- Latitude and Longitude: Coordinates of the market.
- Product Category: The category of the food product (e.g., oil, fats, nuts, etc.).
- Products (commodity): Specific food items (e.g., rice, lentils, wheat).
- Unit: The unit of measurement for the product (e.g., kg).
- Price in BDT: The price of the product in Bangladeshi Taka.
- Price Type: The type of price recorded (e.g., wholesale, retail).
- Currency: The currency in which the price is recorded.
- Price in USD: The equivalent price in US Dollars.

1.2 Purpose of the Analysis

The primary objective of this analysis is to investigate food price dynamics in Bangladesh through the use of Microsoft Power BI with data cleaning, analysis, and visualization. By posing data-driven questions, the analysis seeks to identify trends, patterns, and variations in food prices across various regions, markets, and product categories during the observed period. The goal is to create an interactive dashboard that effectively communicates these insights to stakeholders such as policymakers, researchers, and business analysts, while also providing a comprehensive report that highlights key findings and actionable recommendations.

Key objectives include:

- **Monitoring Price Trends**: Track and analyze fluctuations in commodity prices over time across different regions and markets.
- **Geospatial Analysis**: Assess regional price disparities across districts and divisions, exploring how spatial factors such as market location (latitude/longitude) influence pricing.
- **Commodity Price Comparison**: Compare the prices of various commodities within the same category or across different categories to identify significant trends and anomalies.
- **Currency Analysis**: Investigate price changes in both local currency (BDT) and USD to understand how exchange rate shifts impact food prices in the market.

Provide actionable insights for policymakers, economists, or market stakeholders to inform food security strategies, pricing regulations, or supply chain optimizations in Bangladesh.

1.3 Data Cleaning Process: I have utilized power query for data cleaning process.

Column statistics	...
Count	14178
Error	0
Empty	0
Distinct	314
Unique	0
Empty string	0
Min	1998-07...
Max	2024-08...

Fig: Power Query screen

- **Header Row Adjustment**: Set the first row as the header to correct column naming. ensuring that the column names are accurate and correspond to the data.
- **Removing Unnecessary Rows**: Removed the first row containing metadata. The first row contained metadata about the dataset, which needed to be removed.
- **Column Profiling**: Enabled column profiling to check for errors; no errors were found.
- **Handling Null or Blank Values**: Using column profiling, no significant errors were detected in the dataset under the "Error Value" section
- **Data Type Conversion**: Converted "latitude" and "longitude" from text to Decimal Number for accurate geospatial mapping. Converted "price" and "usdprice" from text to Decimal Number for proper calculations.
- **Renaming Columns**: Renamed "admin1" to Division and "admin2" to District for clarity.

Outlier handling: I identified oil price 680 which is far from median 111 BDT, I replaced outlier with median price of the oil.

These steps ensured that the dataset was cleaned and ready for analysis in Power BI.
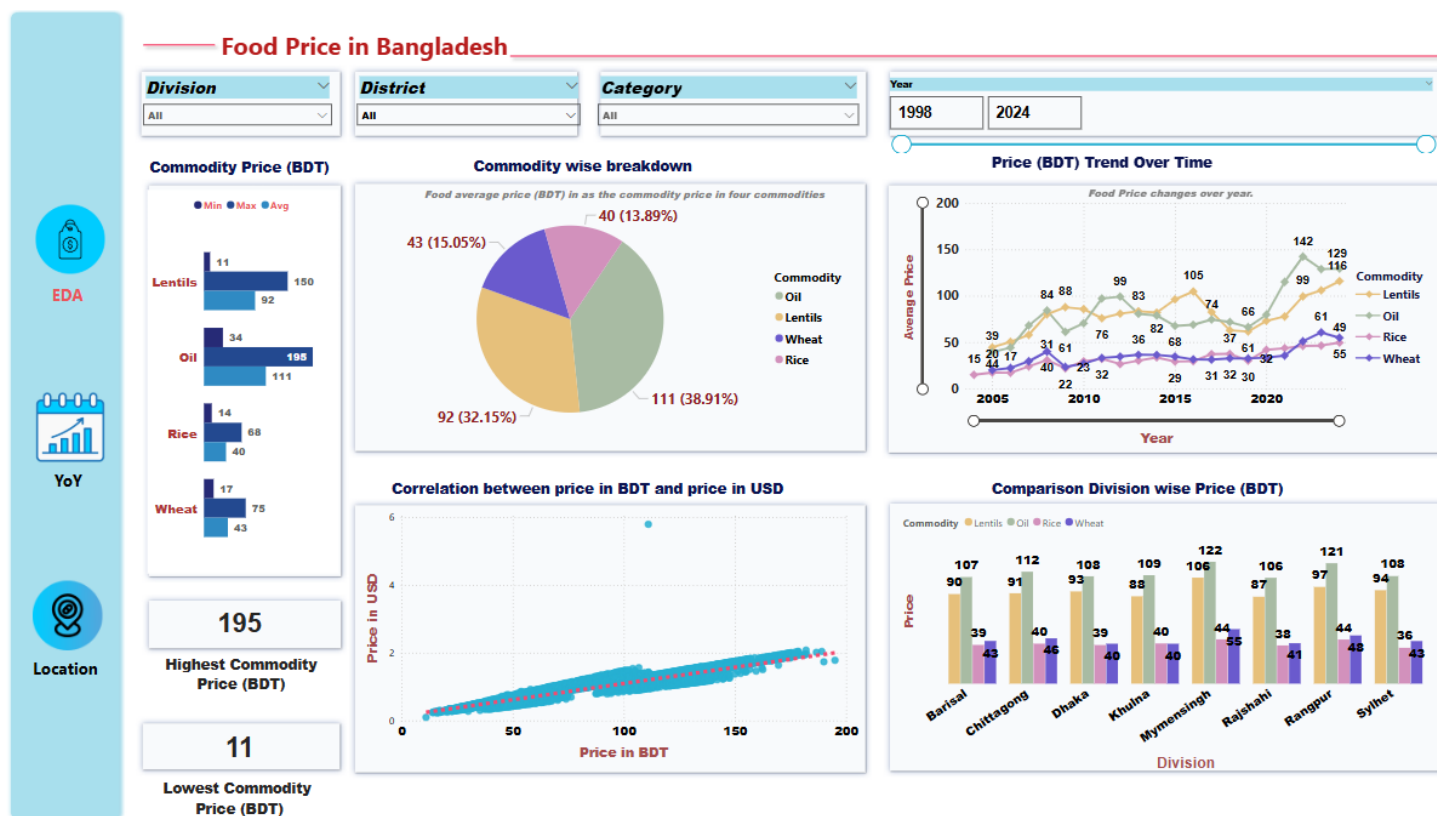
2. Research Methodology

Fig: Dashboard - First Page

Summary Findings:

1. **Historical Food Price Trends**: from the market history of Bangladesh we know that

   - From 2005-2008 I found food price sharp increase, like Rice from 17.05 BDT to 30.51 BDT, Lentils from 44 to 80 , Oil 39 to 84 and Wheat 19.75 to 39 BDT, as external faction I identified **Global Food Price Surge in 2007–2008**, depreciation of the U.S. dollar, export restrictions from the Countries like India and Vietnam impacted food prices during this periods.
   - From 2009–2012 also global food crisis significantly impacted Bangladesh, with rice prices peaking at 21–26 BDT per kg in 2012. Oil 60 to 99, Wheat 23 to 37 BDT.
   - From 2020–2024: The COVID-19 pandemic and subsequent supply chain disruptions, coupled with global inflation, pushed food prices higher. By 2023–2024, rice prices reportedly reached 41–49 BDT, Oil 79 o 129, Lentils 61 to 115 and Wheat 33 to 54 BDT per kg in some markets, seeing significant increases.

2. **Regional Variations Identified**:

   - **Mymensingh shows the widest price range**: Mymensingh has the largest price variation, with Lentils at 106 BDT, Oil at 122 BDT, Rice at 44 BDT, and Wheat at 55 BDT, indicating diverse commodity pricing dynamics in this division compared to others.
   - **International price influence on Oil and Lentils**: The elevated and stable prices of Oil and Lentils across divisions suggest a direct impact from international market prices, likely due to import dependency for these commodities in Bangladesh.

3. **Commodity Price Variations Identified:**

   - **Oil consistently has the highest prices**: Oil prices peak at 142 BDT around 2022, remaining the highest throughout the period, with notable spikes in 2008 (88 BDT) and 2020-2022 (131-142 BDT), likely due to international market influences and import dependency.

   - **Lentils maintain second-highest prices**: Lentils show a steady increase, peaking at 142 BDT in 2021, with prices generally ranging from 74 BDT (2015) to 142 BDT, reflecting their high cost and sensitivity to global supply chains.

Fig: Dashboard - Year Over Year analysis Page

Summary Findings:

1. **YoY Price (BDT) Comparison (Division):**

   - This chart highlights the year-to-year price changes (in BDT) for specific commodities (e.g., wheat, rice, oil, lentils) within a selected Division and Selected Year with previous year.

   - It allows users to quickly identify short-term price fluctuations, such as the significant 18.778 BDT drop in oil prices, enabling targeted analysis of market volatility and informing immediate supply chain or pricing adjustments.

2. **YoY Compound Annual Growth Rate Price(%) Comparison with (Division):**

   - By showing the CAGR from a base year (e.g., 2006) to a selected year (e.g., 2013) for a division, this chart provides a long-term perspective on price growth trends (e.g., 9.941% for oil).

   - It helps stakeholders understand the annualized rate of price increases, assess inflation impacts, and plan for sustainable food security strategies over extended periods.

3. **YoY Price (BDT) Comparison with (All Division):**

   - This chart compares Chittagong's YoY price changes with the national average, revealing regional disparities (e.g., rice dropping 1.894 BDT more in Chittagong than nationally).

   - It aids in benchmarking regional performance, identifying areas of competitive pricing or supply issues, and supporting policy decisions tailored to specific divisions.

4. **YoY Compound Annual Growth Rate Price(%) Comparison with (All Division):**

   - This chart compares Chittagong's CAGR with the national average (e.g., 0.928% higher for oil), offering insights into long-term regional price growth relative to the country.

   - It assists in evaluating whether Chittagong's market aligns with or deviates from national trends, guiding investment or intervention strategies based on relative growth rates.
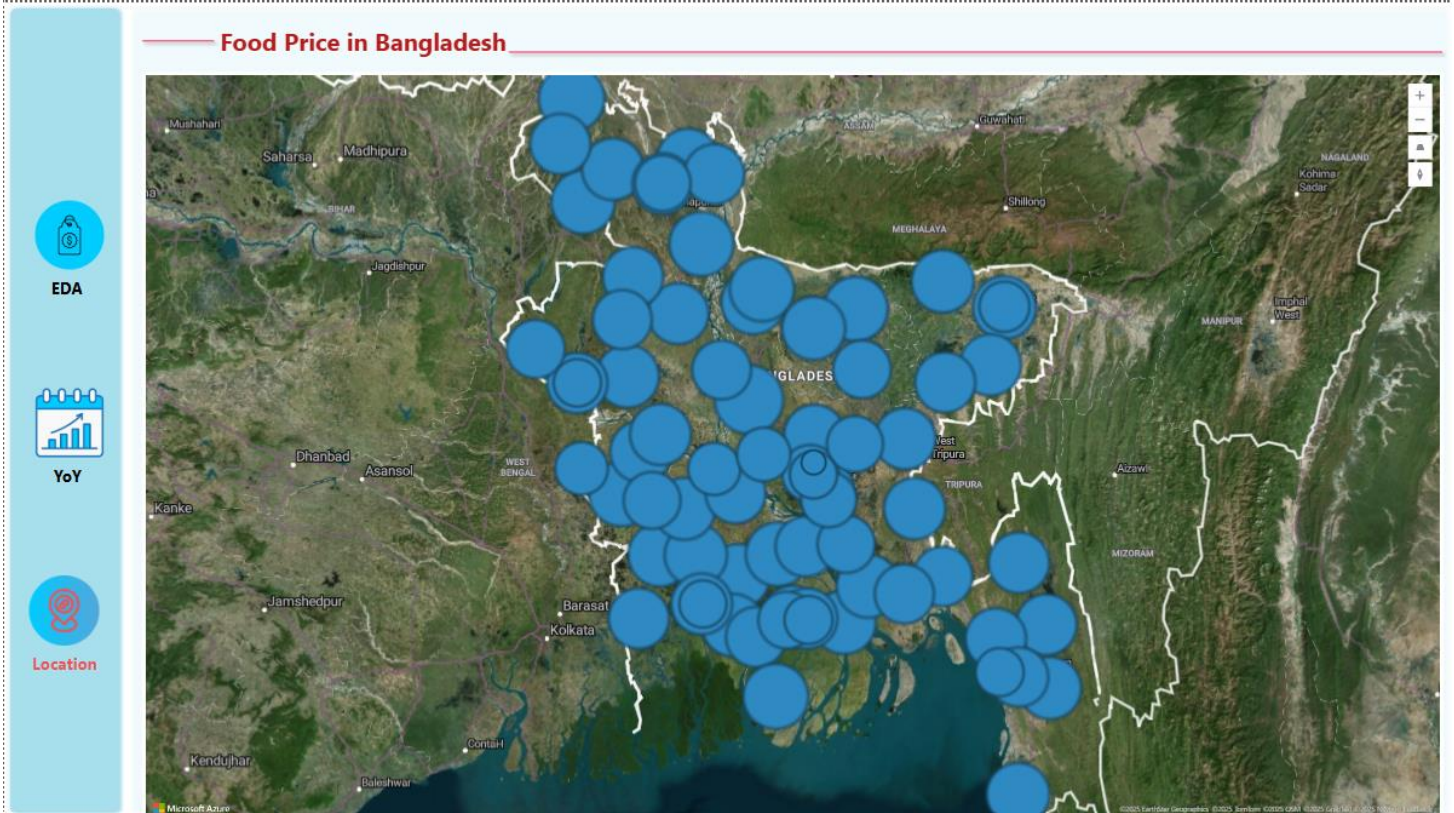
Fig: Dashboard – Food Price in Map Page

Summary:

"Food Price in Bangladesh" map on the dashboard visualizes location-wise food prices across Bangladesh using a bubble map, where each bubble represents a market or data collection point with its size or color (in this case, blue bubbles) likely indicating the average food price or price variation at that location.

2.1 Exploratory Data Analysis (EDA)

EDA was conducted to understand the underlying patterns, correlations, and distributions in the data.

Commodity Price (Min, Max, Average) in BDT: The chart provides the minimum, maximum, and average prices (in Bangladeshi Taka, BDT) for four essential commodities in the Bangladesh food market: Lentils, Oil, Rice, and Wheat.
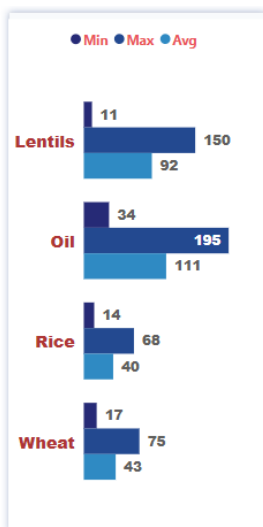
Key Insights:

- **Lentils** exhibit significant price variation, from 11 BDT to 150 BDT, indicating market instability or supply issues that may affect accessibility for lower-income households.

  o The average price of 92 BDT is closer to the maximum, suggesting that higher prices were more common over time.

- **Oil** shows the highest volatility, ranging from a minimum of 34 BDT to a maximum of 195 BDT, likely due to import dependency or fluctuations in global prices.

- The average price of 111 BDT is **significantly lower than the maximum**, indicating occasional sharp price spikes.

- **Rice** prices range from 14 to 68 BDT, and **Wheat** prices range from 17 to 75 BDT, reflecting relatively stable pricing that supports affordability for consumers.

Fig: Commodity Price (Min, Max, Average)

Pie Chart Analysis: The pie chart illustrates the percentage distribution of average commodity prices (in BDT) across four commodities—Rice, Wheat, Lentils, and Oil—based on the dataset. The legend identifies the commodities, with their shares of the total commodity price as follows: Oil (avg. price 111 BDT, 38.94%), Lentils (avg. price 92 BDT, 32.13%), Rice (avg. price 40 BDT, 13.88%), and Wheat (avg. price 43 BDT, 15.04%).
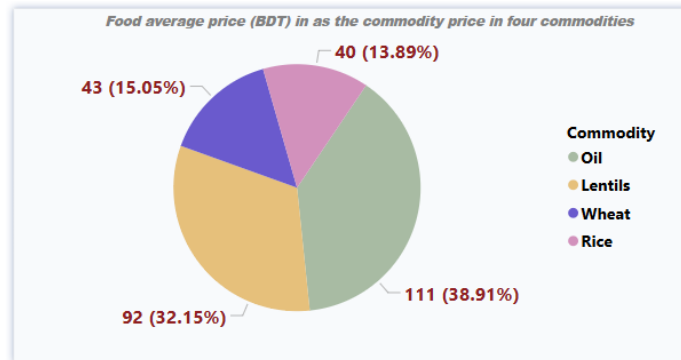
Key Insights:

Fig: Pie chart of commodity average price breakdown.

- **Oil dominates in both share and price**: Oil has the largest share of commodity prices (38.94%) and the highest average price (111 BDT), indicating it is the most expensive commodity in our food consumption habits.
- **Lentils follow as a costly commodity**: Lentils, with a 32.13% share, have an average price of 92 BDT, making them a significant but slightly less expensive commodity compared to Oil.
- **Rice and Wheat show stable, affordable pricing**: Rice (13.88%, avg. price 40 BDT) and Wheat (15.04%, avg. price 43 BDT) have similar average prices, reflecting affordability and stability for consumers despite their smaller shares.
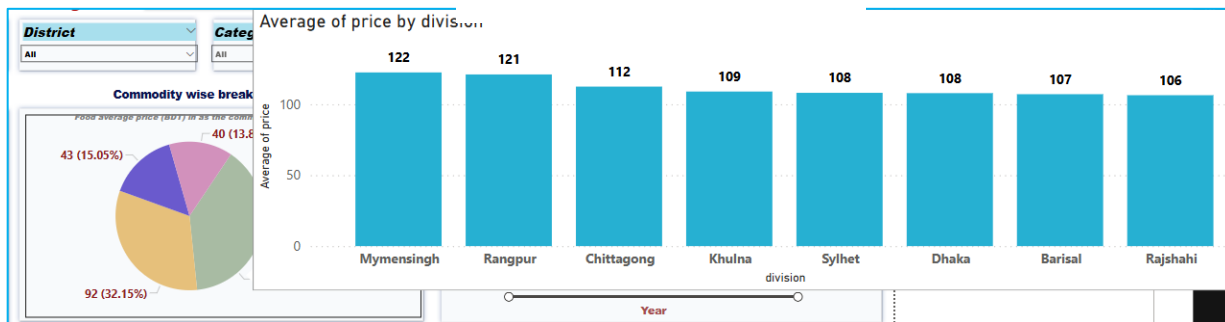

Fig: Tooltip in pie chart, shows division average commodity price.

Scatter Plot: The image is a scatter plot with a trend line, illustrating the relationship between two variables: "Price in Taka" (on the x-axis) and "Price in USD" (on the y-axis). Here's a detailed explanation:
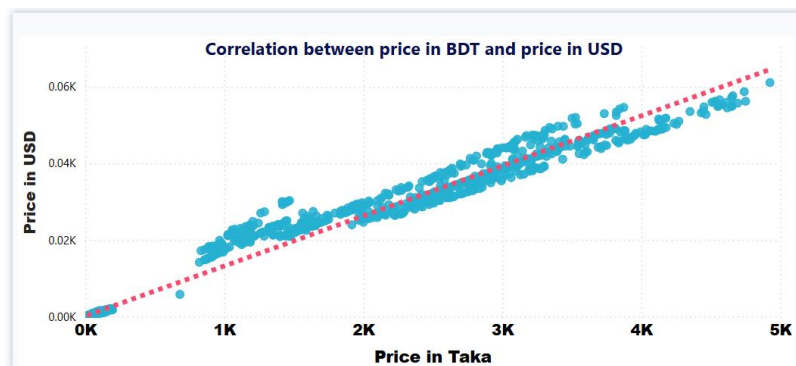

Fig: Correlation between price in BDT and price in USD

Key Insights:

- **Positive Correlation**: There is a clear positive correlation between the food price in Taka and the food price in USD. As the price in Taka increases, the price in USD rises proportionally, which aligns with expectations for currency conversion or price scaling.

- **Linear Relationship**: The trend line suggests a roughly linear relationship between the two prices, meaning the conversion or scaling factor between Taka and USD is relatively consistent across the range of prices shown.

Clustered Column Chart Analysis: The clustered column chart displays the average prices (in BDT) of four commodities—Lentils, Oil, Rice, and Wheat—across eight divisions in Bangladesh: Barisal, Chittagong, Dhaka, Khulna, Mymensingh, Rajshahi, Rangpur, and Sylhet. The x-axis represents the divisions, the y-axis shows the average price, and the legend identifies the commodities: Lentils (dark blue), Oil (light blue), Rice (medium blue), and Wheat (lightest blue).
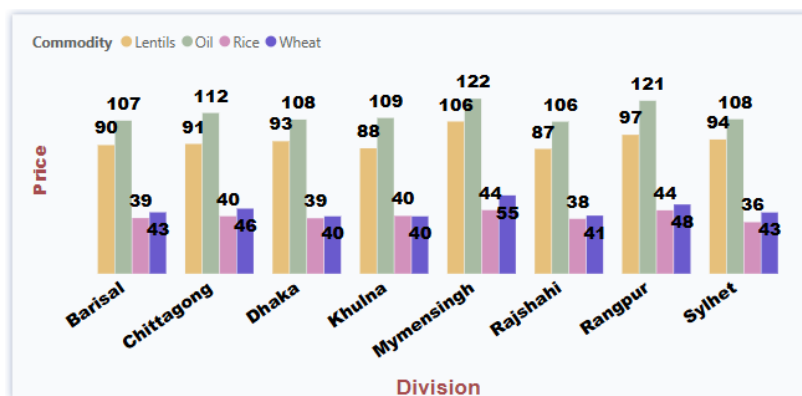

Fig:

Key Insights:

- **Oil consistently have the highest average price:** Oil show the highest average prices across all divisions, ranging from 87 BDT (Rajshahi) to 112 BDT (Chittagong), indicating they are the most expensive commodity in every region.

- **Lentils prices are relatively stable but high**: Lentils has the second-highest average prices, ranging from 88 BDT (Mymensingh) to 106 BDT (Mymensingh), with less variation across divisions, suggesting stable but elevated costs.

- **Rice and Wheat prices are lower** : Rice and Wheat have similar average prices, with Rice ranging from 33 BDT (Rajshahi) to 44 BDT (Mymensingh) and Wheat from 36 BDT (Sylhet) to 55 BDT (Mymensingh), reflecting affordability and consistent pricing for these staples.
- **Mymensingh shows the widest price range**: Mymensingh has the largest price variation, with Lentils at 106 BDT, Oil at 122 BDT, Rice at 44 BDT, and Wheat at 55 BDT, indicating diverse commodity pricing dynamics in this division compared to others.
- **International price influence on Oil and Lentils**: The elevated and stable prices of Oil and Lentils across divisions suggest a direct impact from international market prices, likely due to import dependency for these commodities in Bangladesh.

Line Chart (Price Trends over Time): The line chart illustrates the trend of average food prices (in BDT) for four commodities—Lentils, Oil, Rice, and Wheat—from 2005 to 2024. The x-axis represents the years, the y-axis shows the average price, and the legend identifies the commodities. The chart tracks price fluctuations over this period, highlighting significant changes in commodity prices.
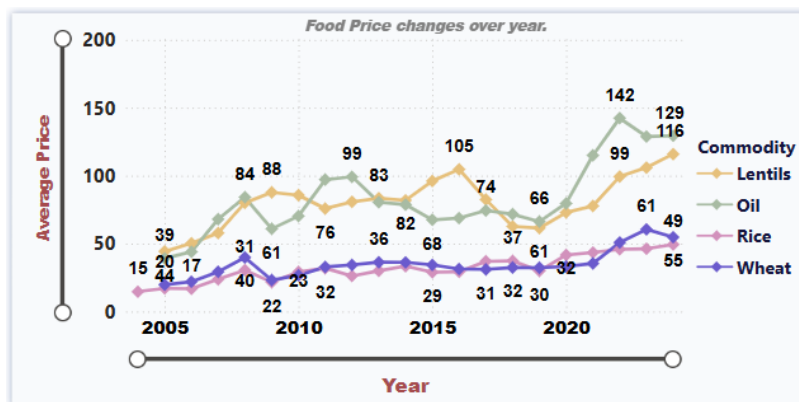

Fig:

Key Insights:

- **Oil consistently has the highest prices**: Oil prices peak at 142 BDT around 2022, remaining the highest throughout the period, with notable spikes in 2008 (88 BDT) and 2020-2022 (131-142 BDT), likely due to international market influences and import dependency.

- **Lentils maintain second-highest prices**: Lentils show a steady increase, peaking at 142 BDT in 2021, with prices generally ranging from 74 BDT (2015) to 142 BDT, reflecting their high cost and sensitivity to global supply chains.

- **Wheat prices are moderate but volatile**: Wheat prices fluctuate between 29 BDT (2015) and 68 BDT (2015), with a peak around 2015, indicating periodic price instability that may affect affordability for this staple.

- **Rice prices remain the lowest and most stable**: Rice, a key staple, has the lowest prices, ranging from 15 BDT (2005) to 61 BDT (2015), with minimal fluctuations, suggesting effective domestic production and price control measures.

YoY Price (BDT) Comparison (Division): The chart titled "YoY Price Changes (BDT) in "Selected" (in pic Chittagong) Division in "Selected Year" with slicer (in pic 2012 - 2013) visualizes the year-over-year (YoY) price difference in Bangladeshi Taka (BDT) for key commodities (Wheat, Rice, Oil, and Lentils) in the Chittagong Division, comparing retail prices between Previous Year (2012) and Selected Year (2013). The data is derived from the provided dataset, and the calculation is based on the DAX formula (annex I), which computes the difference in average retail prices for a selected division (Chittagong) between two consecutive years (2013 and 2012).
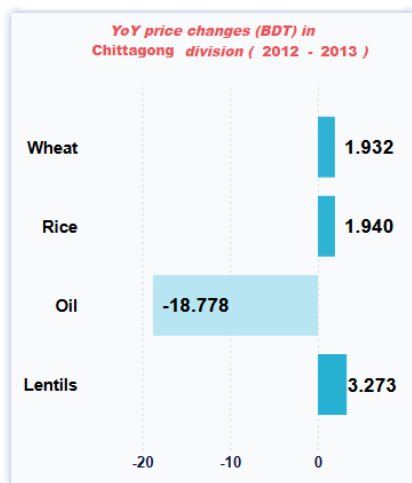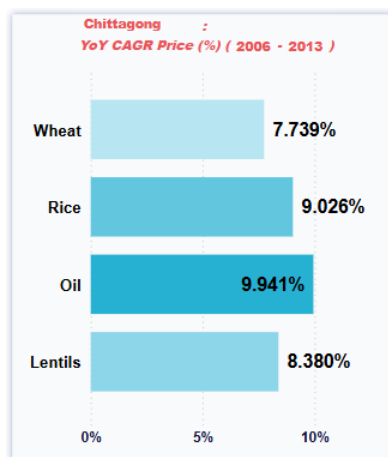

Key Findings:

- **Track Price Inflation/Deflation**: It shows how the average retail prices of essential commodities have changed from 2012 to 2013, helping stakeholders understand inflation or deflation trends.

- **Support Decision-Making**: For related stakeholders like businesses, and consumers, this chart highlights which commodities are becoming more expensive or cheaper, aiding in budgeting, procurement, or policy adjustments (e.g., subsidies, import/export regulations).

- **Identify Market Dynamics**: It reveals how different commodities are affected by economic factors, such as supply chain issues, agricultural production, or global market trends, within the Chittagong Division.

Fig: YoY Price (BDT) Comparison (Division)

YoY Compound Annual Growth Rate Price(%) Comparison with (Division):

The chart titled "YoY CAGR Price (%) (2012 - 2013)" displays the Compound Annual Growth Rate (CAGR) of retail prices for key commodities in the Chittagong Division, comparing the years Base Year(2006) and Slicer selected year (2013). However, based on the DAX formula (annex II), the chart represents the CAGR of retail prices from a base year (2006) to a selected year.


Key Findings:

- **Measure Long-Term Price Growth**: Calculate the CAGR of retail prices for commodities in Chittagong Division from 2006 (base year) to a selected year (e.g., 2012 or 2013).

- **Compare Commodity Trends**: Show how different commodities (e.g., Wheat, Rice, Oil, Lentils) have appreciated in price over the years, expressed as a percentage.

- **Support Strategic Analysis**: Help stakeholders (e.g., policymakers, businesses) understand the annualized growth rate of commodity prices, which can inform inflation tracking, cost-of-living adjustments, or agricultural policy decisions.

Fig: YoY CAGR Price(%) Comparison with (Division)

Key Findings from the Chart

1. **Highest Growth in Oil Prices:** Oil has the highest CAGR at 9.941%, indicating that its price grew at an annualized rate of nearly 10% from 2006 to 2013.

2. **Consistent Growth Across Commodities:** All commodities show positive CAGRs between 7.739% (Wheat) and 9.941% (Oil), suggesting a general inflationary trend in Chittagong over the 7-year period.

3. **Rice and Lentils Growth:** Rice (9.026%) and Lentils (8.380%) also show strong annualized growth, though the chart values slightly differ from manual calculations, possibly due to missing Chittagong data for 2013.

4. **Wheat with the Lowest Growth:** Wheat has the lowest CAGR at 7.739%, indicating relatively slower price growth compared to other commodities.

YoY Price (BDT) Comparison with (All Division): The chart titled "Chittagong vs. All Divisions: YoY Price Change (BDT) (2012-2013)" compares the year-over-year (YoY) retail price change in Bangladeshi Taka (BDT) for commodities in Chittagong Division against the average YoY price change across all divisions in Bangladesh, focusing on the years 2012 and 2013. The data is derived from the dataset, and the calculation is based on the provided DAX formula (Annex III), which computes the difference between Chittagong's YoY price change and the average YoY price change across all divisions.

Chittagong vs. All Divisions:
YoY Price Change (BDT) (2012 - 2013)

Wheat   -0.221
Rice   -1.894
Oil   -0.132
Lentils   0.633
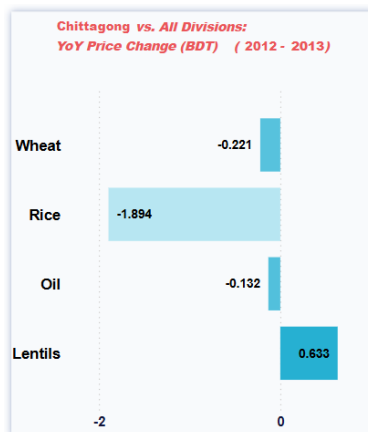
Purpose of the Chart

- **Compare Regional Price Trends**: It evaluates how price changes in Chittagong Division align with or deviate from the national average (across all divisions), highlighting regional economic disparities or consistencies.

- **Identify Relative Inflation/Deflation**: It helps stakeholders understand whether Chittagong is experiencing higher or lower price changes compared to the rest of Bangladesh, which can inform targeted economic policies or interventions.

- **Support Market Analysis:** For businesses and policymakers, this chart provides insights into whether Chittagong's market is more or less volatile than the national average, aiding in supply chain or pricing strategies.

Key Findings from the Chart

1. **Rice Prices Dropped More in Chittagong**:

   o Rice shows the largest negative difference (-1.894 BDT), meaning its price dropped more in Chittagong (-7.93 BDT) than the average across all divisions (-5.465 BDT). This suggests Chittagong experienced a sharper decline in rice prices, possibly due to local surplus or market dynamics.

2. **Wheat and Oil Also Declined More in Chittagong**:

   o Wheat (-0.221 BDT) and Oil (-0.132 BDT) indicate that Chittagong saw slightly larger price decreases compared to the national average, though the differences are small. This could reflect regional variations in supply or demand.

3. **Lentils Prices Increased Similarly**:

   o Lentils show a small positive difference (0.633 BDT), suggesting that the price increase in Chittagong (15 BDT) was slightly higher than the national average. This might indicate higher demand or supply constraints in Chittagong.

4. **Data Limitations**:

   o The calculations are based on limited data (only Chittagong and Barisal), as other divisions (Dhaka, Khulna, Rajshahi, Sylhet) lack complete data for 2012-2013. The chart values likely include additional data from these divisions, explaining discrepancies between manual calculations and chart figures.

YoY Compound Annual Growth Rate Price(%) Comparison with (All Division)

The chart titled "Chittagong vs. All Divisions: YoY CAGR Price (%) (2012 - 2013)" compares the Compound Annual Growth Rate (CAGR) of retail prices for commodities in Chittagong Division to the average CAGR across all divisions in Bangladesh, from a base year of 2006 to the selected year of 2013. The data is derived from the dataset, and the calculation is based on the DAX formula (Annex IV), which computes the difference between Chittagong's CAGR and the average CAGR across all divisions, expressed as a percentage.
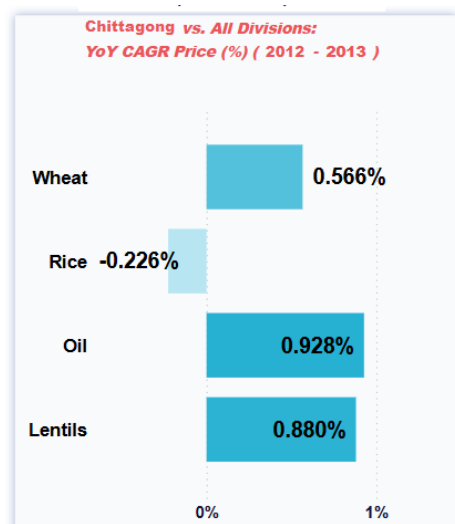
Purpose of the Chart

- **Compare Long-Term Price Growth Trends**: It evaluates how the annualized price growth (CAGR) of commodities in Chittagong from 2006 to 2013 compares to the national average, highlighting whether Chittagong's price growth is faster or slower than the rest of Bangladesh.

- **Assess Regional Inflation Dynamics**: It helps stakeholders understand if Chittagong is experiencing higher or lower long-term price inflation compared to the national average, which can inform regional economic policies or market strategies.

- **Support Strategic Decision-Making**: For policymakers and businesses, this chart provides insights into whether Chittagong's market has been more or less inflationary over the long term, aiding in decisions related to pricing, subsidies, or supply chain adjustments.

Fig: YoY CAGR Price(%) Comparison with (All Division)

Key Findings from the Chart

1. **Rice Grew Slower in Chittagong**:

   - Rice shows a negative difference (-0.226%), suggests Rice prices in Chittagong grew at a slower annualized rate, possibly due to local production or market factors.

2. **Wheat, Oil, and Lentils Grew Faster in Chittagong**:

   - Wheat (0.566%), Oil (0.928%), and Lentils (0.880%) show positive differences, meaning their CAGRs in Chittagong were higher than the national average. This indicates that Chittagong experienced slightly stronger long-term price growth for these commodities, possibly due to higher demand or supply constraints.

3. **Small Differences Overall**:

   - The differences are relatively small (ranging from -0.226% to 0.928%), suggesting that Chittagong's long-term price growth from 2006 to 2013 was generally aligned with the national average, with minor regional variations.

2.2 Final Dashboard

Power BI WFP Food
distribution Student ID

3. Conclusions and Recommendations

3.1 Summary of Findings

- **Historical Trends and External Impacts Confirmed**: Food prices in Bangladesh spiked sharply from 2005–2008 (e.g., rice from 17.05 BDT to 30.51 BDT) due to the global food crisis, export restrictions, and rising oil prices, with continued increases post-2020 (e.g., rice at 41–49 BDT by 2023–2024) due to pandemic-related disruptions , inflation, Russia-Ukrain war.

- **Significant Price Variations Identified**: The analysis reveals notable regional and commodity-specific price differences, with Chittagong's 2013 average food price at 58 BDT compared to the national 55 BDT, and Mymensingh showing the widest price range (e.g., lentils at 106 BDT, oil at 122 BDT), driven by urban demand and import dependency.

- **YoY and Long-Term Growth Insights:** Chittagong's YoY analysis (2012–2013) shows a sharp oil price drop (18.778 BDT) in 2013 compared with 2012 but increases in rice (1.940 BDT) and lentils (3.273 BDT), while CAGR (2006–2013) indicates steady growth (e.g., 9.941% for oil), highlighting both short-term volatility and long-term inflationary trends.

- **Actionable Visualization Tools:** The dashboard's maps, charts, and DAX measures effectively visualize price trends and regional disparities, supporting policymakers in addressing food security through targeted interventions like subsidies or supply chain optimizations.

4.   References

Annex I:

```
1_YoY_AvgYearSalesDiff =
VAR SelectedYear = VALUE(SELECTEDVALUE(wfp_food_prices_bgd[Year]))
VAR SelectedDivision = SELECTEDVALUE(wfp_food_prices_bgd[division])
VAR PrevYear = SelectedYear - 1


VAR YoY_AvgSalesSelectedYearThisDivision =
CALCULATE(
AVERAGE(wfp_food_prices_bgd[price]),
 wfp_food_prices_bgd[Year]=SelectedYear ,
 wfp_food_prices_bgd[division]=SelectedDivision,wfp_food_prices_bgd[pricetype]="Retail"

)

VAR YoY_AvgSalesPrevYearThisDivision =
CALCULATE(
AVERAGE(wfp_food_prices_bgd[price]),
 wfp_food_prices_bgd[Year]=PrevYear ,
 wfp_food_prices_bgd[division]=SelectedDivision,wfp_food_prices_bgd[pricetype]="Retail"

)


RETURN YoY_AvgSalesSelectedYearThisDivision -YoY_AvgSalesPrevYearThisDivision
```

Annex II:

```
4_CAGR_RetailPrice_Commodity =
VAR BaseYear = 2006 VAR
SelectedYear = VALUE(SELECTEDVALUE(wfp_food_prices_bgd[Year]))
VAR SelectedDivision = SELECTEDVALUE(wfp_food_prices_bgd[division])

-- Average price in the base year (2006)
VAR PriceBaseYear = CALCULATE( AVERAGE(wfp_food_prices_bgd[price]), wfp_food_prices_bgd[Year] = BaseYear,
wfp_food_prices_bgd[division] = SelectedDivision, wfp_food_prices_bgd[pricetype] = "Retail" )

-- Average price in the selected year (e.g., 2018)
VAR PriceSelectedYear = CALCULATE( AVERAGE(wfp_food_prices_bgd[price]), wfp_food_prices_bgd[Year] =
SelectedYear, wfp_food_prices_bgd[division] = SelectedDivision, wfp_food_prices_bgd[pricetype] = "Retail" )

-- Number of years between base year and selected year
VAR NumberOfYears = SelectedYear - BaseYear

-- CAGR calculation: ((PriceSelectedYear / PriceBaseYear)^(1/NumberOfYears)) - 1
VAR CAGR = IF( NOT ISBLANK(PriceBaseYear) && NOT ISBLANK(PriceSelectedYear) && PriceBaseYear <> 0 &&
NumberOfYears > 0, (PriceSelectedYear / PriceBaseYear) ^ (1 / NumberOfYears) - 1, BLANK() )

RETURN CAGR
```

Annex III:

```
3_YoY_AvgPriceDiff_vs_AllDivisions =
VAR SelectedYear = VALUE(SELECTEDVALUE(wfp_food_prices_bgd[Year]))
VAR SelectedDivision = SELECTEDVALUE(wfp_food_prices_bgd[division])------------------------------------
VAR PrevYear = SelectedYear - 1

  --YoY Price Difference for Selected Division
  VAR YoY_AvgSalesSelectedYearThisDivision = CALCULATE( AVERAGE(wfp_food_prices_bgd[price]),
wfp_food_prices_bgd[Year] = SelectedYear, wfp_food_prices_bgd[division] = SelectedDivision, wfp_food_prices_bgd[pricetype]
= "Retail" )

VAR YoY_AvgSalesPrevYearThisDivision = CALCULATE( AVERAGE(wfp_food_prices_bgd[price]),
wfp_food_prices_bgd[Year] = PrevYear, wfp_food_prices_bgd[division] = SelectedDivision, wfp_food_prices_bgd[pricetype] =
"Retail" )

VAR YoY_Diff_SelectedDivision = YoY_AvgSalesSelectedYearThisDivision - YoY_AvgSalesPrevYearThisDivision

-- YoY Price Difference for All Divisions
VAR YoY_AvgSalesSelectedYearAllDivisions = CALCULATE( AVERAGE(wfp_food_prices_bgd[price]),
wfp_food_prices_bgd[Year] = SelectedYear, wfp_food_prices_bgd[pricetype] = "Retail", ALL(wfp_food_prices_bgd[division]) )

VAR YoY_AvgSalesPrevYearAllDivisions = CALCULATE( AVERAGE(wfp_food_prices_bgd[price]),
wfp_food_prices_bgd[Year] = PrevYear, wfp_food_prices_bgd[pricetype] = "Retail", ALL(wfp_food_prices_bgd[division]) )

VAR YoY_Diff_AllDivisions = YoY_AvgSalesSelectedYearAllDivisions - YoY_AvgSalesPrevYearAllDivisions

-- Compare Selected Division vs All Divisions
RETURN IF( ISBLANK(YoY_Diff_SelectedDivision) || ISBLANK(YoY_Diff_AllDivisions), BLANK(), YoY_Diff_SelectedDivision -
YoY_Diff_AllDivisions )
```

Annex IV:

```
5_CAGR_vs_AllDivisions =
VAR BaseYear = 2006
VAR SelectedYear = VALUE(SELECTEDVALUE(wfp_food_prices_bgd[Year]))
VAR SelectedDivision = SELECTEDVALUE(wfp_food_prices_bgd[division])

-- CAGR for Selected Division
VAR PriceBaseYearSelectedDivision = CALCULATE( AVERAGE(wfp_food_prices_bgd[price]), wfp_food_prices_bgd[Year] =
BaseYear, wfp_food_prices_bgd[division] = SelectedDivision, wfp_food_prices_bgd[pricetype] = "Retail" )

VAR PriceSelectedYearSelectedDivision = CALCULATE( AVERAGE(wfp_food_prices_bgd[price]), wfp_food_prices_bgd[Year] =
SelectedYear, wfp_food_prices_bgd[division] = SelectedDivision, wfp_food_prices_bgd[pricetype] = "Retail" )

VAR NumberOfYears = SelectedYear - BaseYear

VAR CAGR_SelectedDivision = IF( NOT ISBLANK(PriceBaseYearSelectedDivision) && NOT
ISBLANK(PriceSelectedYearSelectedDivision) && PriceBaseYearSelectedDivision <> 0 && NumberOfYears > 0,
(PriceSelectedYearSelectedDivision / PriceBaseYearSelectedDivision) ^ (1 / NumberOfYears) - 1, BLANK() )

-- CAGR for All Divisions
VAR PriceBaseYearAllDivisions = CALCULATE( AVERAGE(wfp_food_prices_bgd[price]), wfp_food_prices_bgd[Year] =
```